

Hose Stream Characterization and Effectiveness Modeling



David W. Stroup, P.E.

Building and Fire Research Laboratory

NIST

National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

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Outline

- **Introduction**
 - Nozzles and Fire Attack
 - Background
 - Fire Fighter Trainer
 - Previous Research
- **Research Objectives**
- **Technical Approach**
 - Laboratory-scale Tests
 - Full-scale Tests
 - Model Development
- **Summary/Future work**



Nozzles

Smooth Bore



Combination/Fog



Fire Attack



Straight Stream

Fog Pattern



Background



- **Controversy continues over nozzle choice for structure fires**
- **Water application methods can impact:**
 - tactical decisions
 - equipment choices
 - water supply requirements
 - fire fighter safety
- **Limited information available concerning effectiveness**



Research Objectives

- **Characterize manual hose streams**
 - flow rate
 - reach
 - pattern
 - drop size characteristics
- **Evaluate the effectiveness for suppressing “real” fires**
- **Develop a model of hose stream fire suppression**



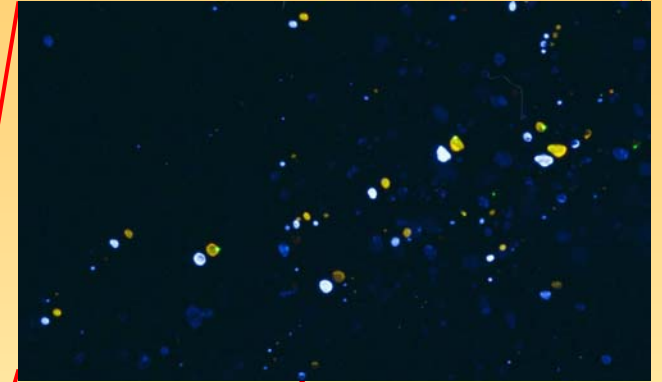
Technical Approach

- **Laboratory-scale Tests**
- Real-scale Tests
- Model Development



Laboratory-scale

Particle Tracking Velocimetry and Imaging (PTVI) Technique



Technical Approach

- **Laboratory-scale Tests**
- Real-scale Tests
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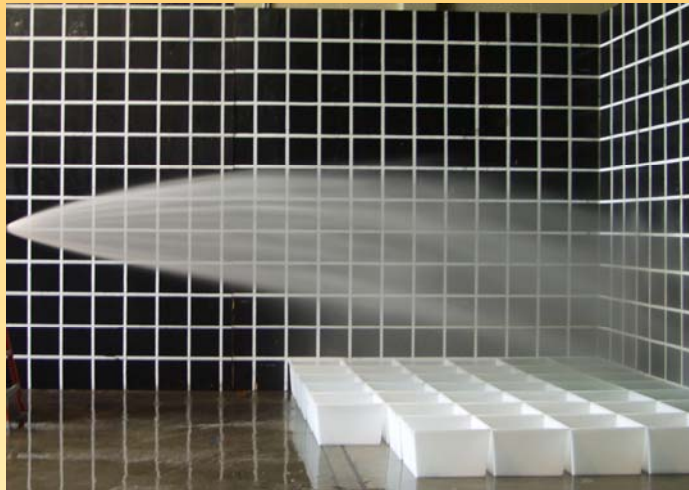


Technical Approach

- Laboratory-scale Tests
- Real-scale Tests
- Model Development



Flow Pattern and Distribution Characterization



Fog Stream

Straight Stream



Compartment Tests

- 7 m x 7 m x 3.3 m
- Opening: 4.6 m wide x 2.1 m high
- Measurements:
 - Gas Temperatures
 - Velocities
 - Heat Flux
 - Mass of Water Delivered
 - Heat Release Rate
- Fuel Sources:
 - Heptane Spray Burner – 2.2 MW
 - Wood Pallets



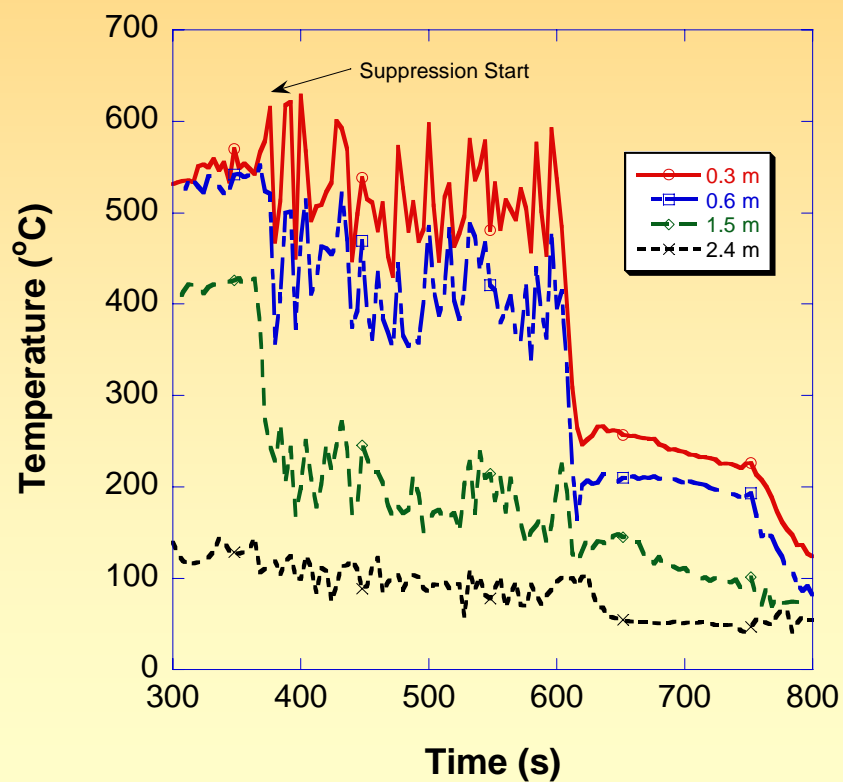
Fog Nozzle Test (2005)



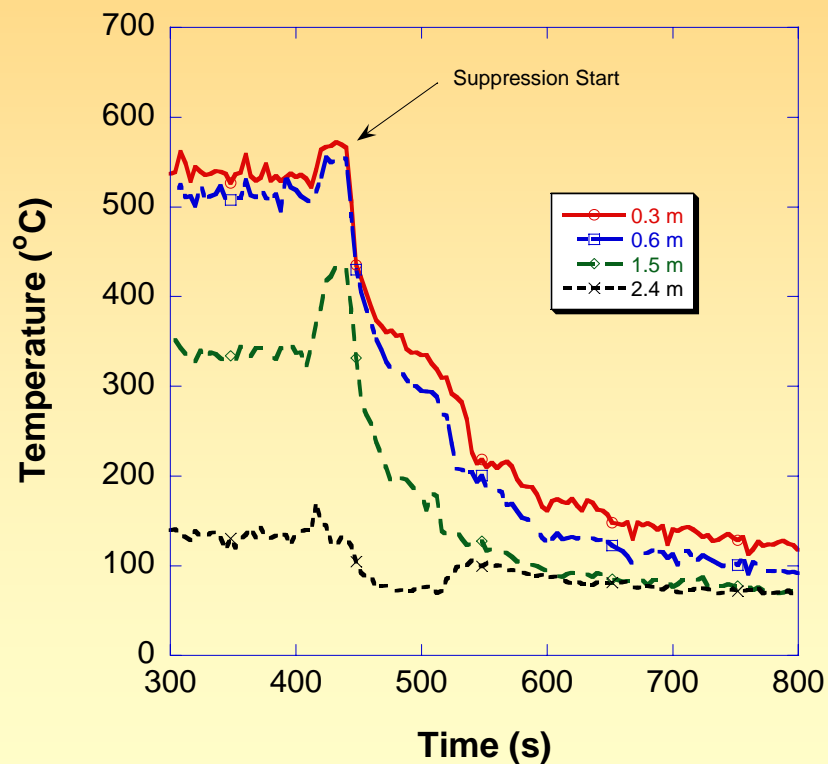
Straight Stream Test (2005)



Results – Fog Nozzle



Results – Smooth Bore Nozzle



Suppression Test (2006)



2:35



Technical Approach

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- Model Development



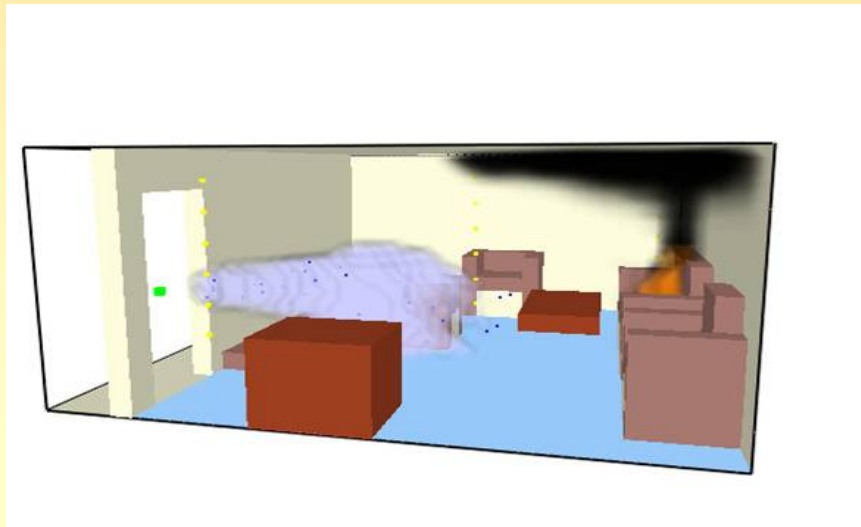
Technical Approach

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- **Model Development**



Model Development

- Fire Dynamics Simulator (FDS) core
- First order approach similar to sprinkler model
- Droplet characteristics?



Summary/Future Work

- **Complete Analysis of Test Results**
- **Use FDS 5 for Modeling**
 - environmental conditions: fire only
 - nozzle characteristics: no fire
- **Complete First Order Fire Suppression Model**
- **Data Comparison**
- **Refine Nozzle Characterization**
- **Additional Questions**
- **Additional Field Tests of Opportunity**

